EDUCATION, SCIENCE & TECHNOLOGY

Reinforcing Asia-Europe Co-operation on Climate Change

ASIA-EUROPE ENVIRONMENT FORUM

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CONTRACTION & CONVERGENCE TOWARDS GREATER EQUITY

“Contraction and Convergence” (C&C) is the policy framework proposed to the United Nations by the Global Commons Institute (GCI) since 1990.

The purpose of C&C is to clarify and resolve the international diplomatic challenge of co-oordinating policies and measures at rates that avoid dangerous global climate change. Based on the objective and principles of precaution and equity, as stated in the **“United Nations Framework Convention of Climate Change” (UNFCCC)**, C&C proposes: -

(1) A full-term contraction budget for global emissions that stabilises the atmosphere at an agreed concentration of greenhouse gases (GHGs).

(2) The international sharing of this budget as ‘entitlements’ resulting from a negotiated rate of convergence to equal shares per person globally by an agreed date within the full-term concentration agreement.

(3) The inter-regional, inter-national and intra-national tradability of these entitlements in an appropriate currency such as International Energy Backed Currency Units [EBCU][1].

(4) Improved understanding of the relationship between an emissions-free economy and concentrations, so rates of C&C evolve under periodic revision.

(5) GHG emissions have so far been closely correlated with economic performance. To date the growth of economies and emissions has occurred mostly in the industrialised countries creating recently a global pattern of increasingly uneconomic expansion and divergence [E&D] and international insecurity.

(6) C&C answers E&D in a ‘full-term’ constitutional, rather than a short-term random manner. It requires a progression from “Guesswork to Framework”. It enables the pre-distribution of future entitlements to emit GHGs that result from a rate of convergence deliberately accelerated relative to the overall agreed rate of contraction in order to resolve and go beyond inertial argument about ‘historic debt’.

This synthesis of C&C can redress the dangerous trend imbalance. Built on global rights, resource conservation and sustainable systems, it is needed to guide the economy to a safe and equitable future for all. It builds on the gains and promise of the UN Convention and establishes an approach that is compelling enough to galvanise urgent international support and action.

Support for C&C grows steadily.[4.]

The presentation includes graphic demonstrations.[5 & 6]

1 http://www.feasta.org
2 http://www.gci.org.uk/zew.pdf [appendix C, page 16]
3 http://www.gci.org.uk/temp/COP3_Transcript.pdf
4 http://www.gci.org.uk/endorsements.html
5 http://www.gci.org.uk/Documents/C&CSlideshow_notes.pdf
6 http://www.gci.org.uk/animations/C&C_Animation.exe

INTRODUCTION

Dangerous climate-change threatens survival. Avoiding it involves establishing global rights. Recognizing resource-constraints, the challenge is to establish and protect these rights in a constitutional - not a chaotic - manner.

In the private and public sectors and for the common good, C&C rises to this challenge. Recognizing "no equity, no survival", a shift from the purely commercial guesswork of "efficiency with (no)-regrets", to the constitutional framework of "equity and survival", is developing in the future vision for the UNFCCC.

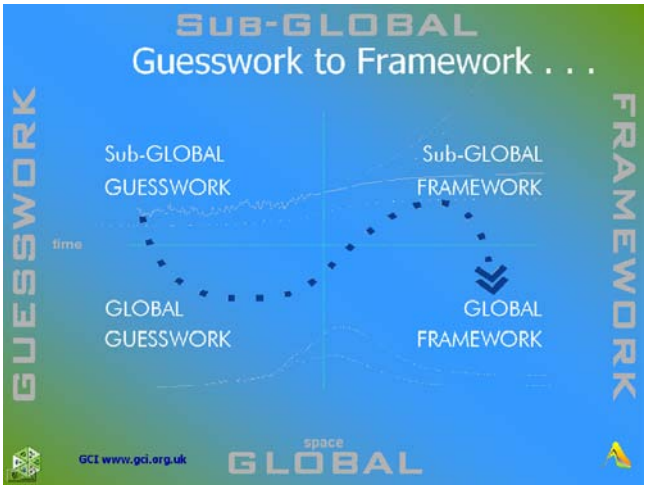
With present trends of "Expansion & Divergence" we face an increasingly uneconomic growth. Reviewing this and economic 'efficiency', GCI's presentation will propose a global-rights-based future in "Contraction & Convergence" (C&C).

We will demonstrate C&C's principles and methods and highlight inititatives and support calling to C&C to become the basis of negotiation at the UNFCCC.

'GUESSWORK' to 'FRAMEWORK'

Progression to C&C

These images illustrate a progression in space and time from 'Guesswork to Framework', or a 'globalisation of consciousness'.

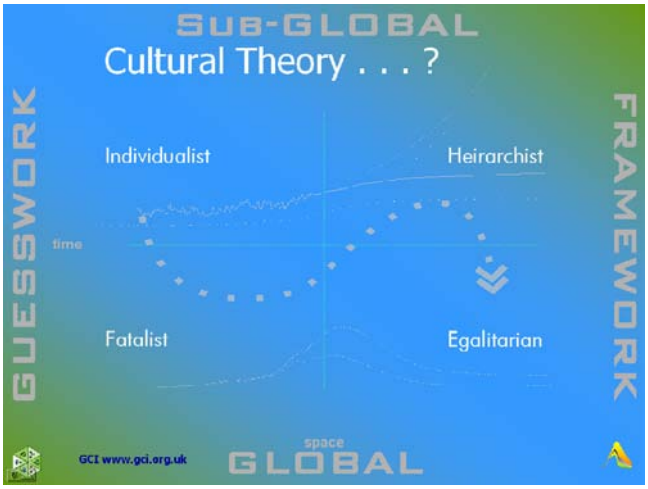


The progression along the dark blue dotted line with the arrow-head is defined through the quadrants created by intersecting axes from: 'sub-global' (or local) to 'global' . . . and from: 'guesswork' to 'framework'.

The left side of the graphic represents the past. The right side represents the future, with and/or without C&C.

Progression as Cultural Theory

This suggests the same progression to the globalisation of consciousness but through the world-views of cultural theory: -

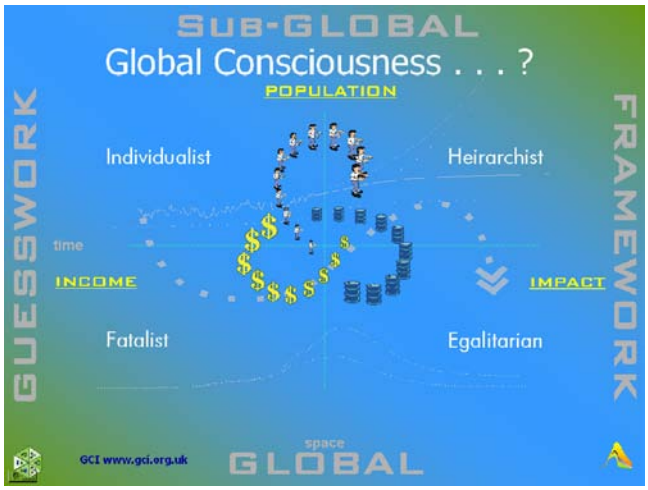


- Individualist or 'predator', in tactical conditions of 'local guesswork':
- Fatalist or 'prey', resigned in a state of global 'che sera sera':
- Heirarchist or 'mediator' with 'sub-global policy frameworks':
- Egalitarian or 'sage' seeing 'conception-constitution', or 'global framework'.

This is a progression taking local competitive autarchy into constitutional democracy and then global governance under precautionary limits to global ghg emissions.

Global Consciousness

This suggests the relationships between: -



- POPULATION [predator/Prey/Mediator/ Sage]
- INCOME, or 'goods' ($=production)
- IMPACT, or 'bads' (oil-barrels=pollution)
- Rising temperature ('flow' or rates of change)
- Rising atmospheric ghg concentrations, ('stock' or accumulations)

moving in opportunity space-time, from short-term individualistic guesswork to a full-term egalitarian global framework for survival.

The IPCC and "C&C"

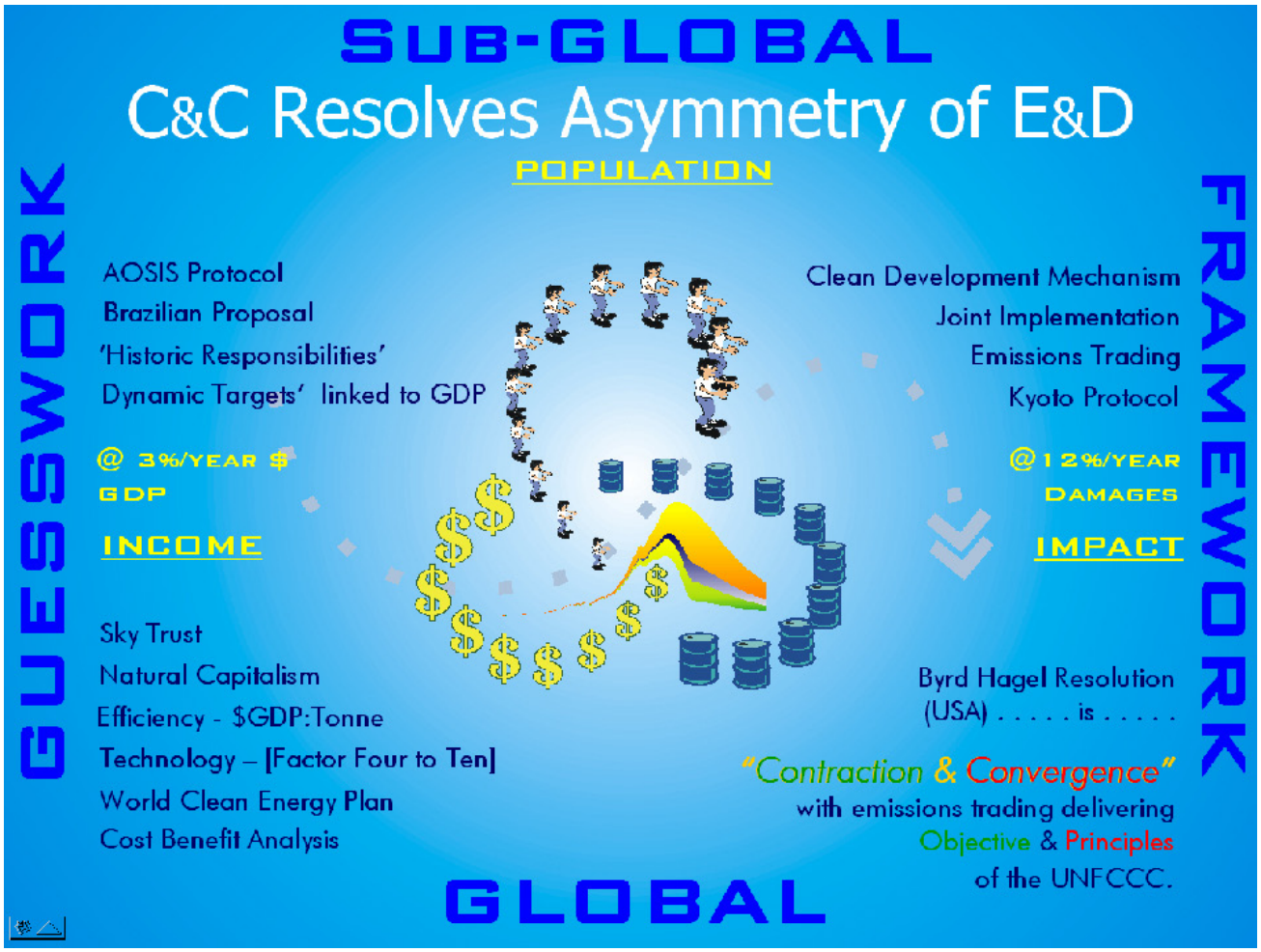
The Intergovernmental Panel on Climate Change (IPCC) has so far produced three "Assessment Reports". The: -

- First Assessment Report (FAR - 1990) established the scientific basis for human-caused climate change.
- Second Assessment Report (SAR - 1995) recognised the asymmetric human causation and effects of climate change.
- Third Assessment Report (TAR - 2001) recognised C&C as, "taking the rights-based approach to its logical conclusion."

The UNFCCC and "C&C"

A secure future depends on avoiding dangerous climate change. This depends on stabilising rising GHG concentrations in the atmosphere by reducing dependence on greenhouse gas emitting sources of energy such as fossil fuels coal, oil and gas.

Between 1990 and 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was created with this purpose. The science is already clear enough for us to know now that when dangerous climate change has been avoided [1] a global contraction of greenhouse gas emissions by 60 to 80% of current output in some time frame will have been completed, and [2] an arranged international convergence of tradable shares in this contraction will also have occurred within the framework of the UNFCCC, and [3] this process will also have resolved the existing asymmetric trends of international "Expansion & Divergence".



Kyoto, Byrd Hagel et al and "C&C"

C&C is required by definition and failure is not an option. C&C simplifies and synthesizes key issues in the global diplomatic effort and makes an effective compromise achievable.

Resisting this before the fact increases the likelihood of failure. Recognising this before the fact increases the chances of success. As the UNFCCC Secreariat now openly says, "[GHG] stabilization inevitably requires Contraction and Convergence."

So all efforts at the the UNFCCC, such the Kyoto Protocol, JI, CDM, renewable-energy-development, efficiency-gains, emissions trading, sink protection and the US Byrd Hagel Resolution are therefore already shaping the UNFCCC into becoming the "United Nations Framework Convention for Contraction & Convergence".

BASIC CLIMATE ECONOMY

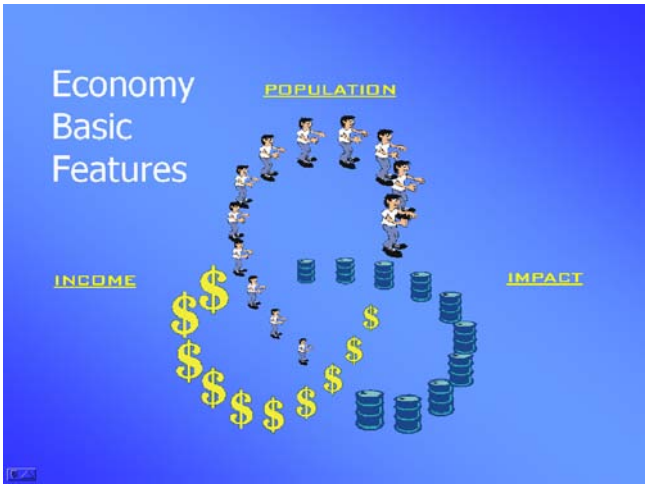
Stock

Here are basic features: -

(1) population

(2) production

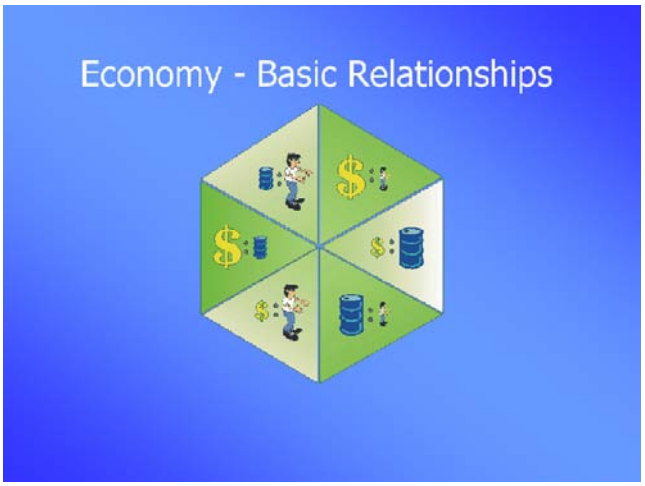
(3) pollution (tonnes of carbon) from CO2 emissions from fossil fuel burning.



Flow

These are growing and feeding back onto the system as a whole as "Expansion & Divergence".

In 2000, Davos CEOs called the rise in ghg emissions, concentrations, temperature and damages, "the devastating trends of climate change". Understood as "Expansion and Divergence", they had good reason to ask, "why had not more been done to avert them?"



Relationships

Here are 3 basic features of the climate economy.

1 high to low dollars per tonne EFFICIENCY
2 low to high dollars/capita INCOME
3 low to high tonnes carbon/capita

IMPACT

Wealth versus Efficiency

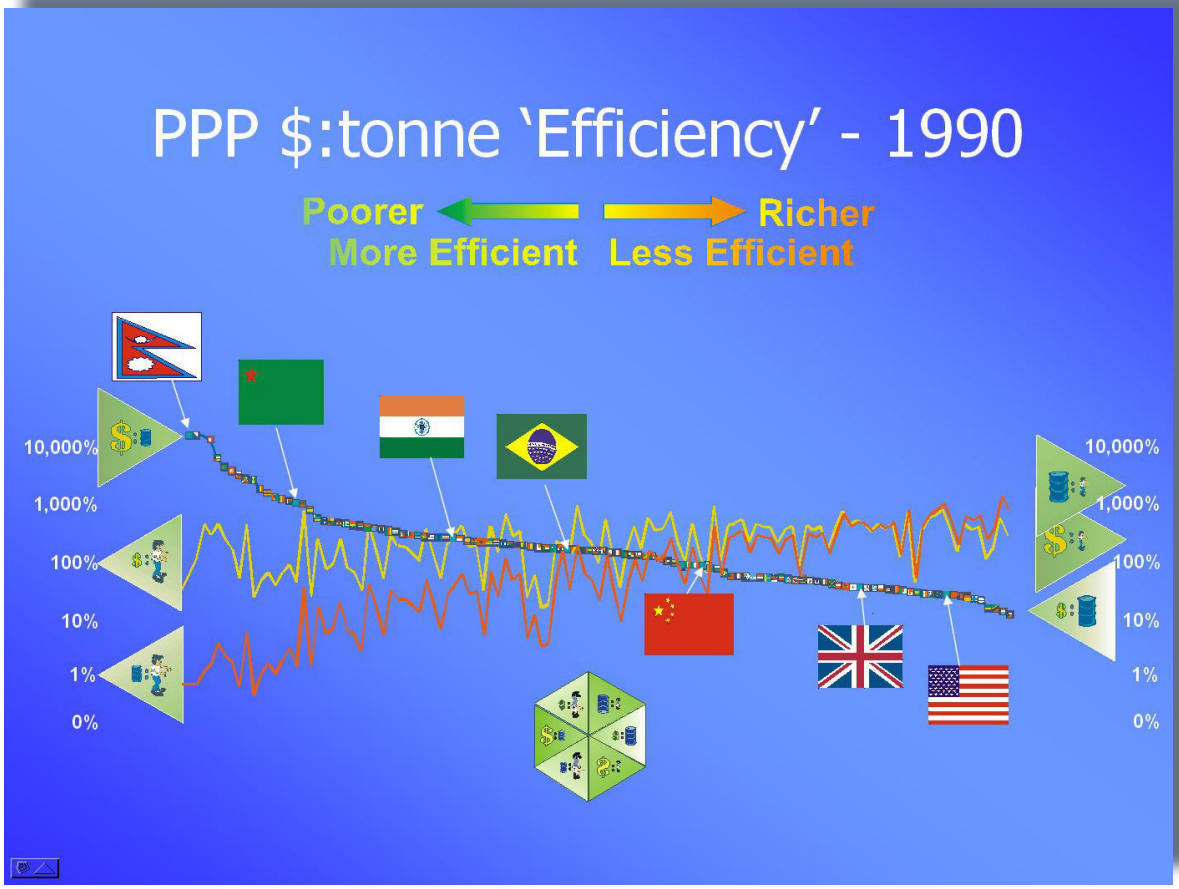
Here are the three basic features of the climate economy assessed for 140 countries for the year 1990. When the income is measured in local purchasing power, the inverse relationship between wealth and efficiency is clear: -

Where per capita INCOME and IMPACT are low there is a high EFFICIENCY value.

Conversely: -

Where per capita INCOME and IMPACT are high there is a low EFFICIENCY value.

Six example countries from high efficiency to low efficiency are shown with their flags: - Nepal; Benin; India; Brazil; China; UK; USA. On present values and at present rates of change, the USA might be as efficient as Nepal by 2100.



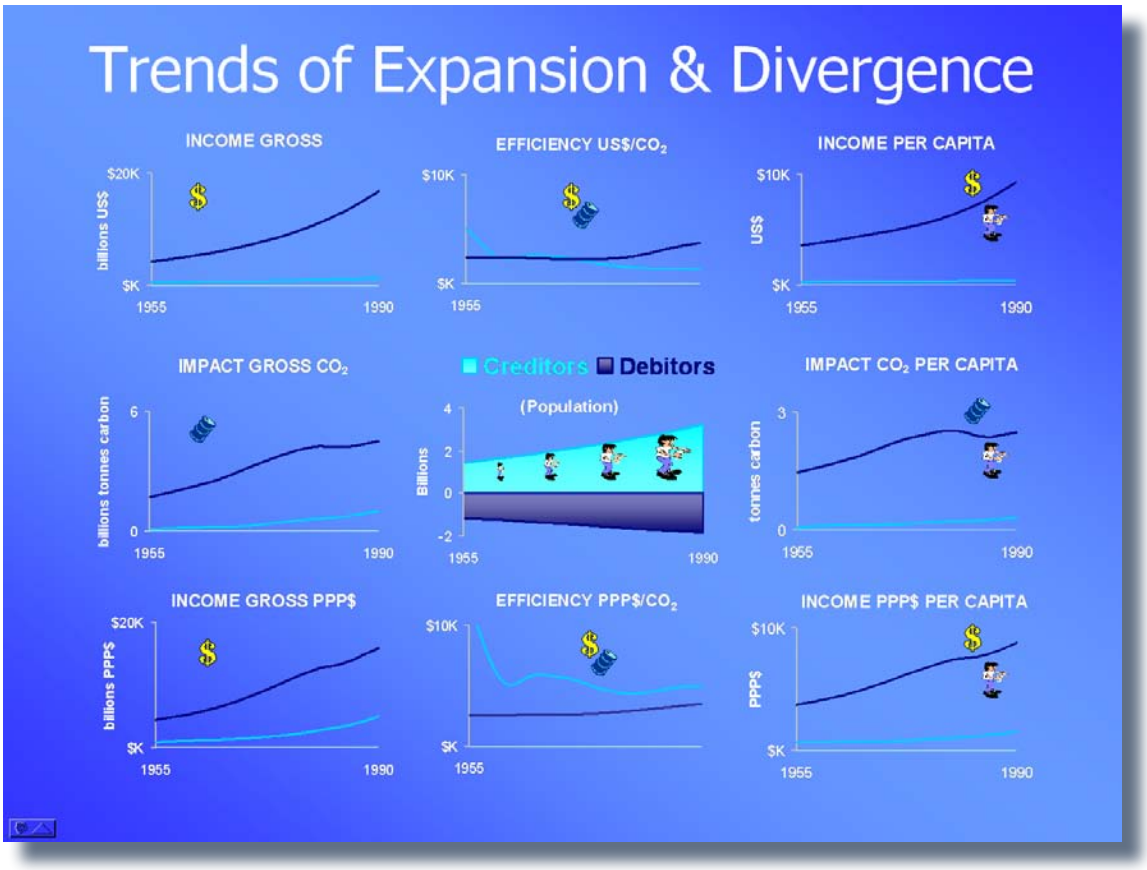
"EXPANSION & DIVERGENCE"

This shows global gross and per capita "Expansion and Divergence" in currency with and without exchange rate corrections (Purchasing Power Parity or PPP) INCOME and CO_2 IMPACT between 1950 and 1990. Similarly efficiencies are shown as US $s & PPP $s per tonne carbon.

The global average US dollars per tonne carbon from fossil fuel burning in 1990 for example was around $3,000 per tonne. The average per capita carbon usage for stable atmospheric concentration of 0.4 tonnes per person per annum. This was converted into a figure for "Sustainably Derived Income" (SDI) reducing the $3,000 by 60%.

While this global SDI was $1,200 per person per annum, national SDI totals were obtained by multiplying that figure by each countries population for that year. These figures were then compared with each nation's US dollar and PPP dollar equivalent income (GDP) to give a "debit" or "credit" figure. Debit here means in any year the amount by which a nation exceeded its SDI total. Credit means in any year the amount by which a nation fell short of its SDI total. "Debitor" means in any year the total number of people in the nations that took more than their equitable share of SDI globally. "Creditor" means in any year the total number of people in the nations that took less than their equitable share of SDI globally.

To reveal the trends this was calculated for each year 1950 to 1990.



The trends show the sum of countries that were; "creditors" and "debitors" in each year; their respective gross and per capita Impacts; their respective gross and per capita Incomes in $US and $PPP; their respective Efficiency trajectories in $US and $PPP. For simplicity the two aggregated groups of countries were shown as "creditors" and "debitors".

When all data for all these years is analysed this way the trends that emerge are devastating, "Expansion and Divergence". With climate already changing, this emphasizes the requirement for "Contraction and Convergence".

For detailed information see: -

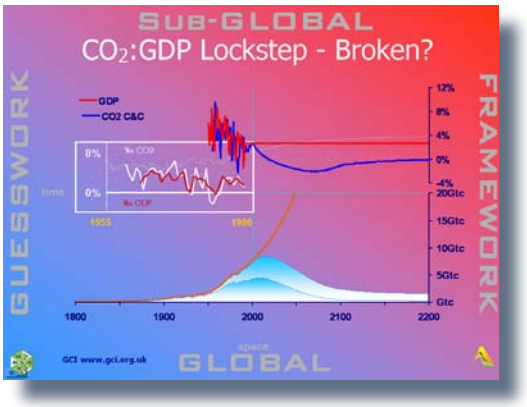
[1] "The Unequal use of the Global Commons" pages 183 - 197 in UNEP/IPCC "Equity & the Social Considerations of Climate Change" ICIPE ISBN 9290640847

[2] "Contraction and Convergence - the Global Solution to Climate Change"

Schumacher Society/Green Books 2000 [Meyer] ISBN 1 870098 94 3
http://www.greenbooks.co.uk/cac/cacorder.htm

Breaking the GDP:CO_2 "Lockstep"

During these same past four decades [1950 until 1990], the output of CO_2 and of GDP from global industry have been correlated nearly 100%.



This is known as 'lockstep' (Detail in Landscape White Box in Slide).

To maintain both growth and a safe climate, breaking this CO_2:GDP lockstep is essential.

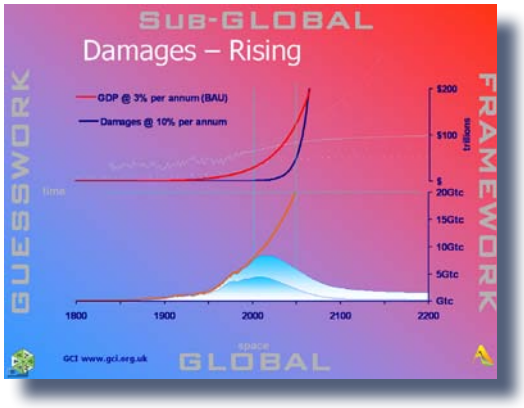
Here, GDP is projected at 3% a year . . .

and CO_2 goes to minus 2% a year, [here following the retreat from fossil fuel dependency shown in the C&C formation below to limit CO_2 concentrations to 70% above the pre-industrial level].

Unless we break the lockstep and correct the asymmetric trends of carbon dependency, the prospect of dangerous climate changes and damages will become inevitable.

Damages

Past damages here are 'uninsured economic losses' estimated by Munich Re for the last five decades. They relate to "Great Weather Disasters", these exclude the associated mortality. The trend of the growth rate over this period has risen at an average of around 12% a year. Gross World Product over the same decades has been at 3% a year. This means that – albeit from a low based figure - damages have grown at around three times the rate of economy.



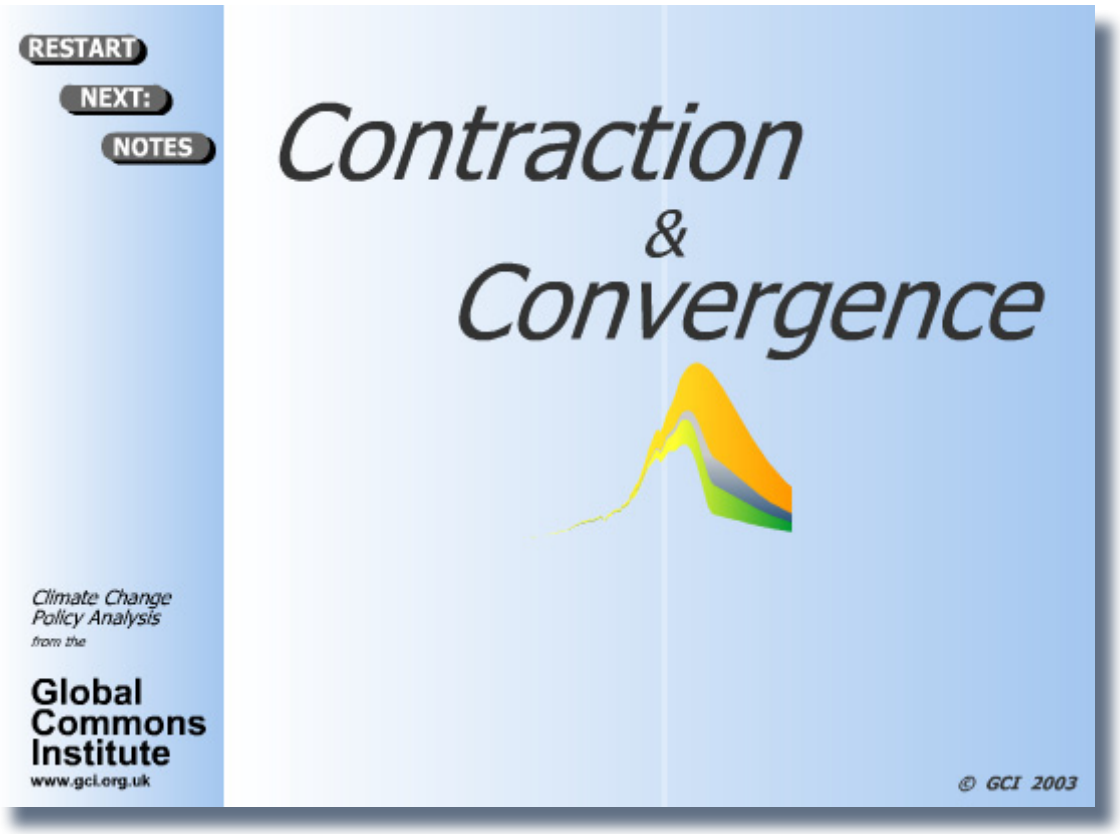
If these global trends are projected on the back of emissions Business-as-Usual (BAU), damages appear to exceed GDP by 2065. This is clearly unsustainable. If we take this path towards this future climate, the risks – let alone the damages - will soon rise beyond the capacity of the insurance industry and even governments to absorb. It is certain that damages will rise for the century ahead even with emissions contraction. However, this rate can be reduced proportional to the rates of a negotiated framework of C&C.

The emissions portrayed, show a contraction of 60% by 2100. The difference between BAU and C&C, is the difference between continuing the chaos prefigured in these data below or organising around the committed purpose of avoiding it.

Great Weather Disasters - (Munich Re-Insurance/UNEP 2001 - $s Billions.)

	1950s	1960s	1970s	1980s	1990s
Events	13	16	29	44	72
Damages	$40	$52	$76	$121	$410

"CONTRACTION AND CONVERGENCE"

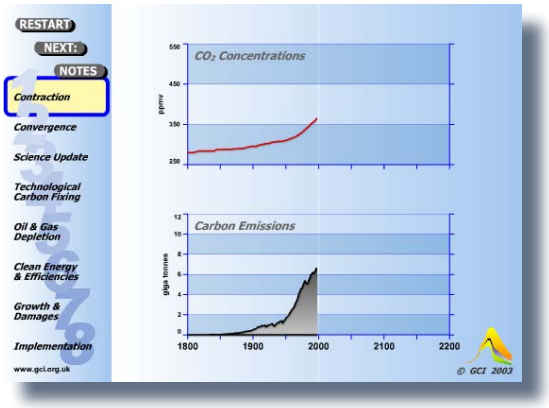


Historic CO_2 Emissions

Industrialisation, achieved largely through the burning of coal, oil and more recently gas for energy, started at the beginning of the 19th Century. From this, greenhouse gas emissions (GHGs) - predominantly carbon dioxide (CO_2) - to the global atmosphere have been rising at an average growth rate of 2 to 3 % per annum. This record of CO_2 emissions has been reconstructed by the Carbon Dioxide Information Analysis Centre (CDIAC) of the US Energy Department, Oakridge, Tennessee. Weighing only the carbon from these emissions, this graph shows these emissions as a global total. Starting at around zero in 1800, the annual output had risen to 6.5 billion tonnes (GigaTonnes carbon or GTC) by the year 2000. Reflected as a dip in global emissions, the great depression can be clearly seen just after 1930 as can both World Wars and the oil shock in the early 70's.

Historic Atmospheric CO_2 Concentrations

During this 200 hundred year period, atmospheric concentration of CO2 rose by over 30%, from 280 parts per million by volume (ppmv) to over 360 ppmv. The rise is explained by the partial and increasing inability of the terrestrial and oceanic biosphere to 'recapture' this extra 'emissions-led' atmospheric CO_2. Plant growth, despite the fertilization effect of more CO_2 in the atmosphere, cannot keep up with the carbon pulse from fossil fuel burning.



This CO_2 concentrations data is also from

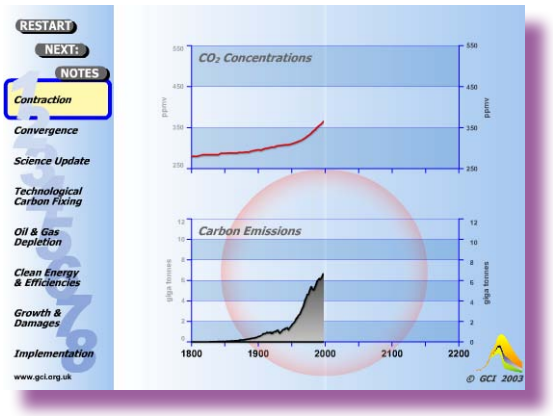
CDIAC. There are various points around the world that now regularly sample for rising atmospheric CO2 concentration. The sampling from all sites tallies very closely, as the atmosphere is a nearly perfect 'mixer' of the GHGs. Recent data shown here is from the site in Mouna Loa.

Not shown here however, are the 500,000 years prior to industrialisation. During this period, we know from the ice-core sampling at the Vostok site in Antarctica, that atmospheric CO_2 content varied between no more than 180 and 280 ppmv. This is true even during and between several ice-ages that occurred in this period.

This means that the rise in CO_2 concentration since 1800 is faster and higher than anywhere in the historic record of the last half a million years, and linked for the first time to human behaviour.

Navigation Ping

"Where are we going?" - The central question posed in this 'radar' image is: - what level of atmospheric CO_2 concentration should be considered as the maximum beyond which 'dangerous' rates of climate change become unavoidable?



The GHGs are called 'greenhouse gases' because they naturally trap heat. Their tri-atomic structure is excited by radiation in the infra-red part of the spectrum. This simple physics means that the higher the GHG concentration in the global atmosphere increases, the more heat will be trapped.

Since 1990, natural and social scientists have been alerting the world to the dangers of continuing deeper into these trends of rising emissions, atmospheric concentrations, temperature and consequential damages.

At the Rio Earth Summit in 1992, the "United Nations Framework Convention on Climate Change" (UNFCCC) was tabled and signed by most countries of the UN. The objective of the UNFCCC is to stabilise atmospheric GHG concentration below a ppmv value that makes 'dangerous' rates of climate change unavoidable. Climate scientists are in agreement that;

(1) the higher the ppmv value, the greater the risks

(2) whatever the value, an ultimate global contraction of emissions in the order of 60 to 80 % of 1990 emissions levels is required to achieve this, as concentrations are 'cumulative' emissions.

GCI suggests it is imprudent to contemplate ppmv levels above 450 ppmv CO_2.

Our reference case - 450 ppmv - is not because we believe this value is safe, but because we believe it should be central when comparing 'more with less dangerous'.

The challenge - "Where are we going?" - embeds the question - "what is the basis of organising to meet this challenge; is it to be a precautionary and directional framework, or is it - as some argue - to be merely the sum of aspirational guesswork?"

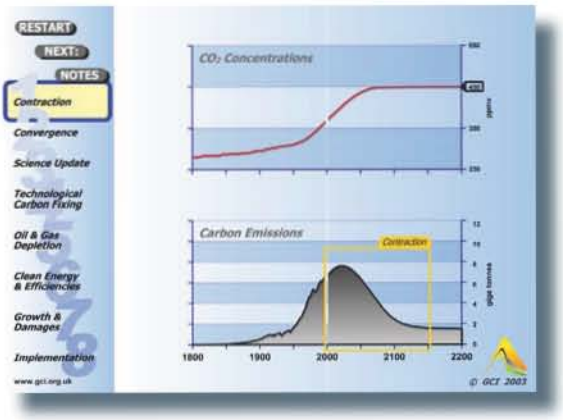
This challenge is the greatest that humanity has yet faced.

"CONTRACTION & CONCENTRATIONS"

Contraction for Concentrations at 450 ppmv

This image shows the volume of CO_2 emissions over the next 100 years that is consistent with stabilising atmospheric CO_2 concentration at 450 ppmv, as published by the scientists of the Intergovernmental Panel on Climate Change (IPCC) in 1994.

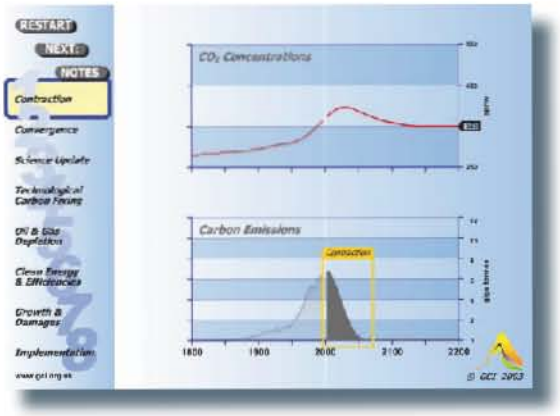
The yellow box around emissions stresses that we call this event as a whole 'contraction', whatever the values chosen.



Contraction for Concentrations at 350 ppmv

This image shows the volume of CO_2 emissions over the next 50 years that is consistent with stabilising atmospheric CO_2 concentration at 350 ppmv.

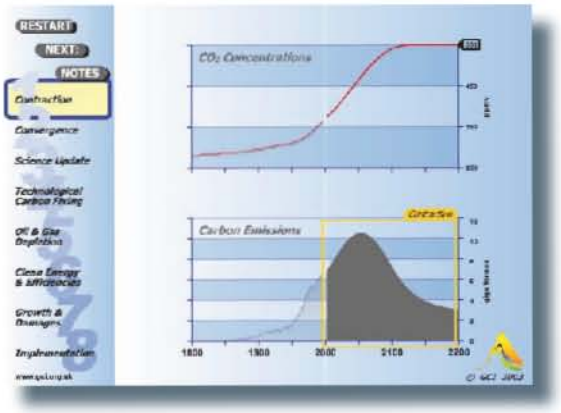
Note that due to 'cumulative' effect of emissions, values below 400 ppmv can only be achieved after peaking at that value and returning to 350 ppmv.



Contraction for Concentrations at 550 ppmv

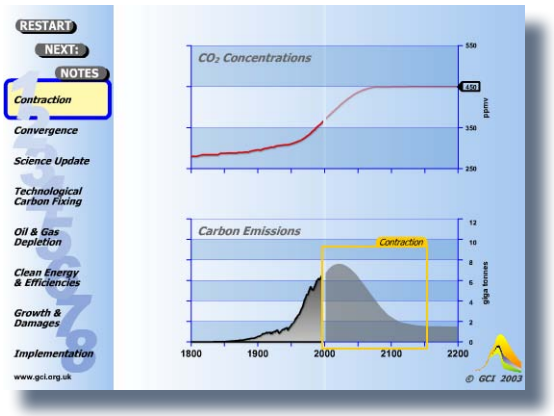
This image shows the volume of CO_2 emissions over the next 150 years that is consistent with stabilising atmospheric CO_2 concentration at 550 ppmv.

In each case, whatever concentration level is selected (in ppmv), it requires a full-term contraction event to achieve it.



SCENARIO OF FUTURE NEGOTIATION

As the world considers the rate and extent of the contraction event required to avoid dangerous climate change, the issue of how to share and manage the event internationally has tested the analytical and negotiating skills of the professionals and experts to deadlock and even breaking point. The conflicts of interest and culture are very great.



GCI has always taken the view that: -

1. The USA has always been correct in asserting the need for global arrangements, as for example in the Byrd Hagel Resolution of the US Senate in June 1997, and
2. The rest of the world has always been right as well in asserting the need for 'differentiated responsibilities' in relation to the contraction event.

The task of negotiating our collective avoidance of dangerous climate change is highly charged because of at least four principal issues: -

1. As the chart on page 11 shows, CO_2 emissions remain almost perfectly correlated with economic growth at this time,
2. As the chart ahead shows, until now, 80% of the historic accumulation of 'extra' GHG emissions in the atmosphere is the responsibility of the so-called industrialised and 'wealthy' countries of the North [this is often referred to as 'historic responsibility' and even 'historic debt'],
3. The impacts of changing climate are already being felt around the world and the trend is persistent, iterative, cumulative and accelerating.
4. The much less wealthy but more vulnerable countries in the so-called 'developing world' of the South are most exposed and least equipped to cope.

In the following slides we demonstrate the rationale for Contraction with Convergence at rates that absorb the historic debt and avoid climate-disaster.

Taken as a whole, C&C unifies the key elements of the increasingly stochastic process at the negotiations and makes the rights-based precautionary principle of the UNFCCC into a numerate and stable procedure.

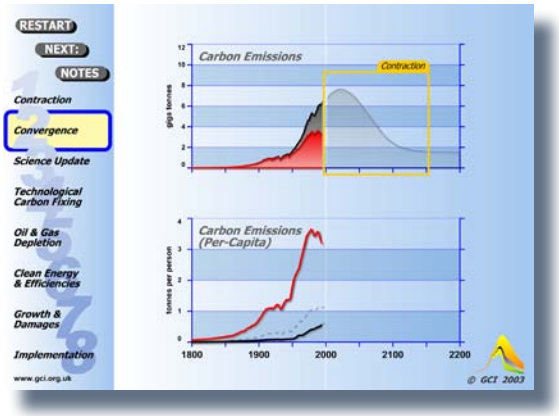
While rates of this procedure are negotiable, and also revisable, C&C's principled framework-structure is constitutional and remains constant.

We judge that only as such, can the asymetric trends of "Expansion and Divergence" be sufficiently corrected and the emerging markets in technolgy conversion be sufficiently guided so that North-South cooperation for the safety of this and future generations will be successful.

The "Expansion and Divergence" of Historic Emissions

Population growth matched the growth of the economy and its emissions very closely since the onset of industrialisation.

This image shows that global per capita emissions average rose from zero in 1800 to around one tonne per person per annum by the year 2000.



The C&C model has population, concentration and emissions data for all countries for all years shown. However, to keep this exposition simple, we show the world sub-dived into two regions: -

1. The Industrial country group in RED
2. The rest of the world in BLACK.

Over the period as a whole: -

1. The red group have emitted over 80% of the emissions, as a cumulative total, and had emissions per capita well above the global annual average [the dotted line in the lower chart] and,
2. The black group have emitted under 20% of the emissions total and had emissions per capita well below the annual global average.

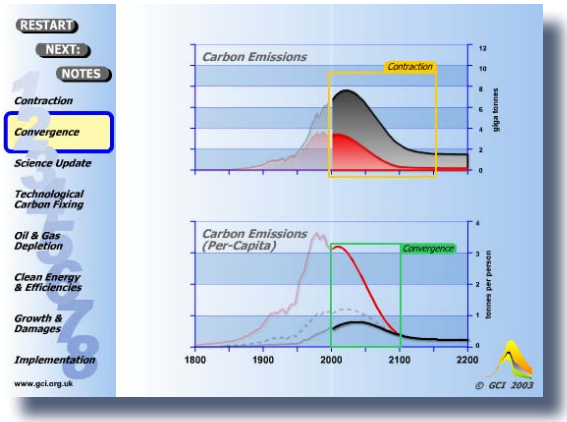
This is "Expansion and Divergence".

Since rising atmospheric concentrations are a function of accumulated emissions and emissions are proportional to GDP, this comparison is the basis of demonstrating the so-called "ecological debt" of the North to the South.

For a full discussion of this issue see, "Climate Change, Population and the Paradox of Growth" GCI 1992, published in Spanish in Medi Ambient i Cultura num. 5, Dept. de Medi Ambient de la Generalitat de Catalunya, Barcelona, in April 1993.

The "Contraction and Convergence" of Future Emissions

Here we have 'frozen' the population data at c. 6 billion people in the year 2000 and then shown the declining future per capita average for carbon consumption as determined by the contraction event in the yellow box above.



This image takes the argument one step further and shows the declining future per capita average for carbon consumption as determined by the contraction event in the yellow box above.

This slide highlights that the 'convergence' aspect of the 'contraction' event is what is contained in the green box; here between 2000 and 2100.

The next sequence shows different rates of convergence within the same rate of contraction.

Negotiable rates of Convergence

These slides highlight that the per capita 'convergence' aspect [highlighted in the green box] of the 'contraction' event can be negotiated so that it is accelerated relative to the global rate of contraction. This feature provides a mechanism whereby developing countries can argue for a resolution of the 'historical debt'.

With a constant contraction event aimed at a concentration stabilisation of 450 ppmv, here are three different rates of convergence.

This feature proposes a method for tackling the central challenge to actors, analysts and negotiators involved in the climate negotiations: - how to negotiate shares in the global retreat from fossil fuel dependency (the contraction event) in an effective, inclusive and non-random manner.

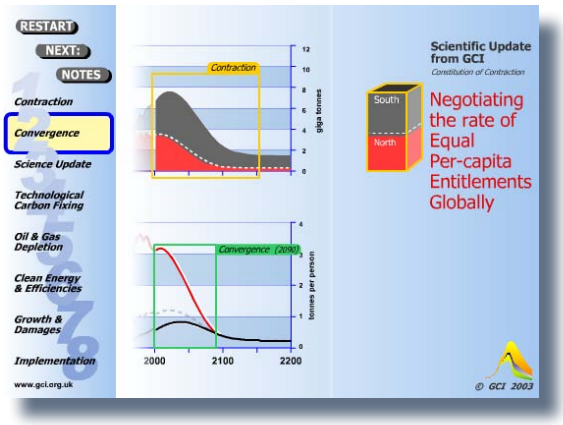
This feature of the C&C method is what we call "accelerated convergence" or more precisely, "convergence accelerated relative to the rate of contraction".

This feature is central to the case for C&C.

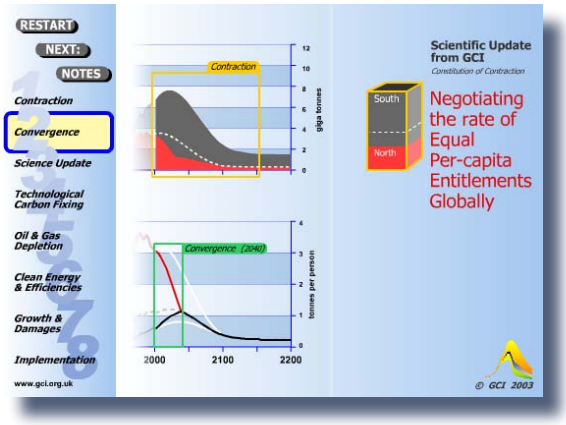
This procedure demonstrates that: -

1. The faster the convergence upon the global per capita average is, relative to a given rate of global contraction, the greater is the future share of the contraction event that is assigned to the South as 'entitlements'.
2. The slower the convergence upon the global per capita average is, relative to the same given rate of global contraction, the greater is the future share of the contraction event that is assigned to the North as entitlements.

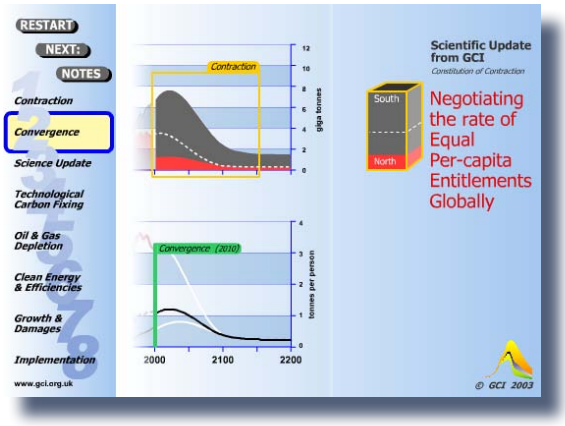
Convergence by 2100



Convergence by 2050



Convergence by 2000



Whatever rates of C&C are considered, the per capita entitlements created this way are scarce and valuable and, subject to appropriate rules, necessarily tradable.

This is "the whole-truth of tradable entitlements" and is globally viable. Remaining stuck in "the half-truth of randomly generated tradable commitments" (as at present) is not. This mechanism is key to resolving the North/South stand-off that has bedevilled negotiations at the UNFCCC for the last fifteen years over the historic debt and meaningful participation.

The past shares in the "expansion and divergence" phase of fossil fuel dependency (albeit unplanned) obviously favoured the rich countries of the North at the expense of the poorer countries of the South (albeit unknowingly). This asymmetry shows the globally polarised economic conditions that face humanity as we contemplate the rising opportunity cost to all of us of unresolved climate change.

The moral case for tackling this asymmetry in a systematic way is self-evident. The logical case for doing this is yet more compelling. Failure is not an option. Moreover future international shares in the contraction event must be determined in advance of any international trading of these shares by definition, as you cannot trade what you do not own.

The constant white dotted line separating the Red Northern and Black Southern shares is deliberately placed as a marker to show the increase in the Southern share as convergence is accelerated relative to contraction.

The key point is that shares in the budget, or initial purchasing power in the global carbon market, can be pre-distributed by convergence accelerated in favour of the South as a way of making the overall arrangement inclusive and effective.

With emissions trading absorbing the difference, entitlements could be the result of convergence by 2030 for example, while actual emissions could retreat at rates similar to those determined by convergence by 2100 (the white dotted line).

The demonstrations includes the same convergence argument at a faster rate of contraction (for 350 ppmv) and a slower rate (for 550 ppmv).

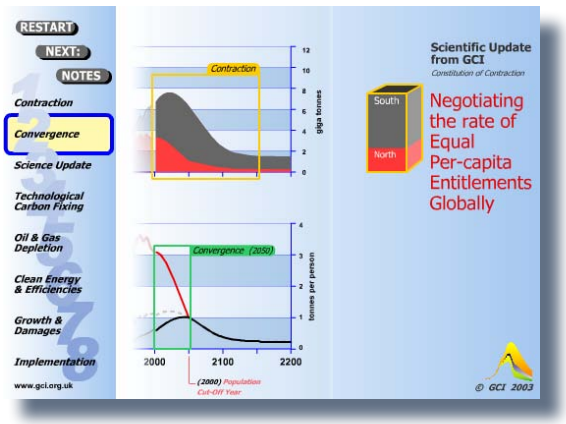
Population Growth - Cut-off Date at 2000 and at 2050

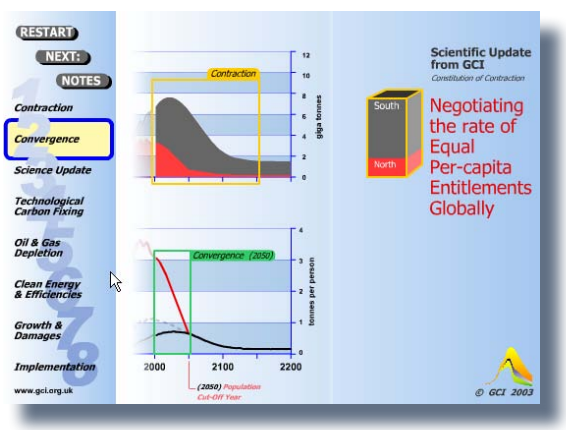
These two slides show the effect on a contraction for 450 ppmv with convergence by 2050, but with UNSTAT projections of 'medium fertility' population growth: -

1. not continued forward beyond 2000 and
2. continued forward in the accounts until 2050.

With the average per capita consumption responding to the projected population growth, particularly in the South, the effect of unfreezing the population projections from a base year at 2000, for any given rate of C&C is to keep the average lower and therefore weight the pre-distribution of entitlements from any rates of contraction and convergence in favour of South.

That said however, the pre-distribution of emissions entitlements is much more sensitive to the rate of convergence than it is to this population freeze/unfreeze function.





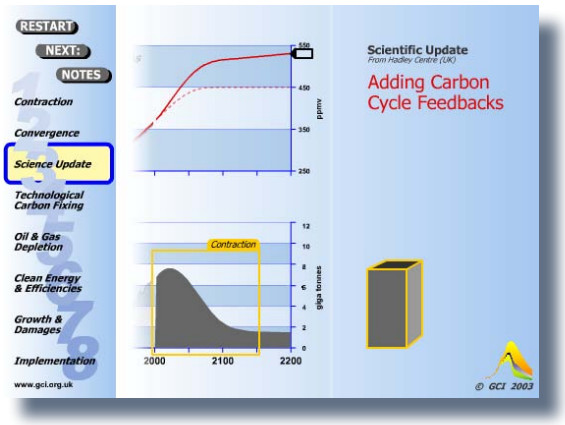
Scientific Update on Carbon Cycle and Sequestration

These slides show the relationship between contraction and concentrations, adjusted for new scientific findings.

Concentration Outcome Exceeded

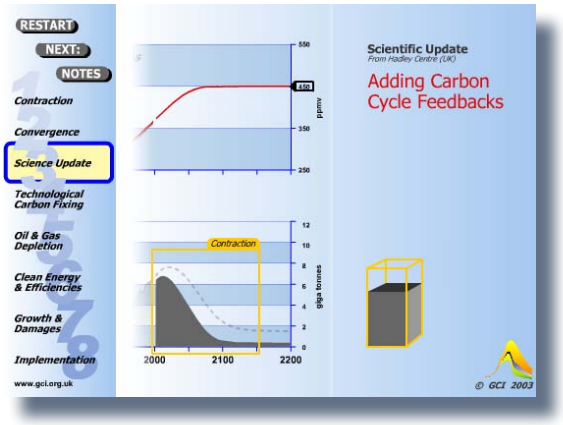
Carbon-cycle feedbacks (forest die-back and soil carbon release as temperature rises) are now being included in the climate models run at the Hadley Centre of the UK Meteorological Office.

Previously given rates for contraction are now understood to lead to higher levels of atmospheric CO_2 concentration in the global atmosphere, or with the. . . .



Emissions Budget Reduced

A dramatically faster contraction event is required to stabilise at the same level of atmospheric concentration (e.g. 450 ppmv),

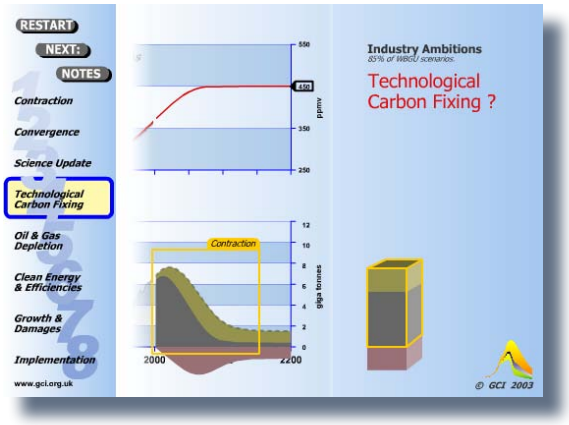


Technological Carbon Fixation

More or less concurrent with these carbon-cycle announcements, there are voices in the corporate sector now arguing to research and commence a process of large-scale geological carbon capture and fixation.

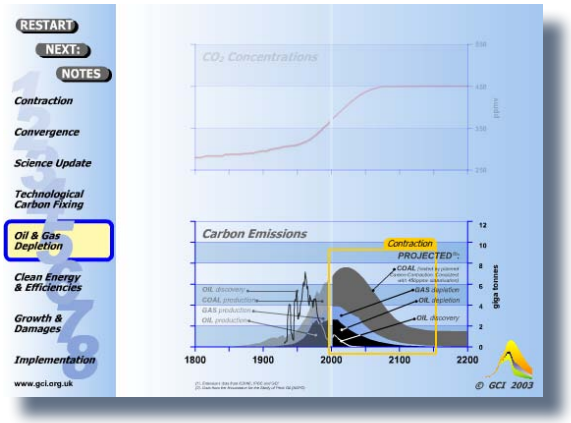
Suggestions for dumping at sea or down disused oil-wells are made.

There are unresolved technical problems associated with these proposals. There is an energy cost to doing this and there is also the problem of full-term security. Liquid and even solid CO_2 in large quantities is unstable and potentially hazardous.



The effect of Oil & Gas Depletion on Contraction

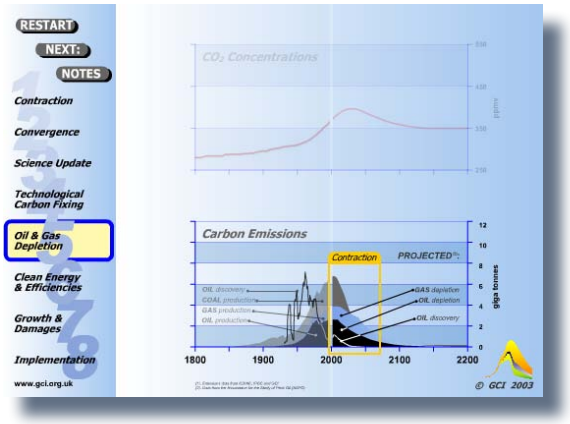
Humanity now consumes over five barrels of conventional crude for every barrel it discovers.



Here is production overlaid with the discovery curve for conventional crude oil as recently been republished by EXXON.

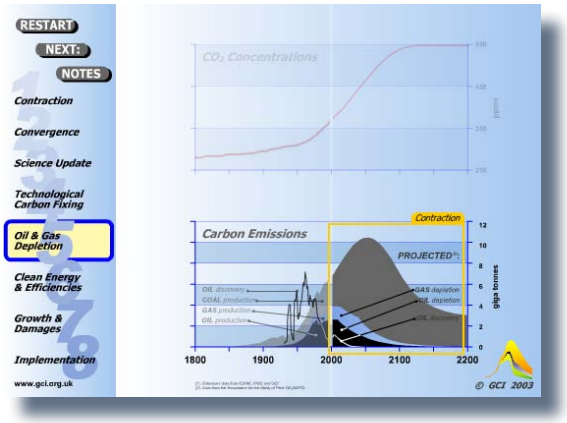
In other words the world's oil dependency is being gradually broken by the geological reality of finite reserves.

At the same time, the climate-question is not so much whether we are running out of oil. The reality is that we are running out of oil too slowly for use of residual oil not to be a contributor to the causation of climate change.



These are the industry data for the production and consumption of oil, gas and coal over the last two hundred years.

The operative point is that you cannot produce and consume what you have not discovered. These data strongly suggest that we are either already at, or fast approaching, peak oil production and consumption.



And, as EXXON's own data reveals, new finds of conventional crude oil are increasingly insignificant.

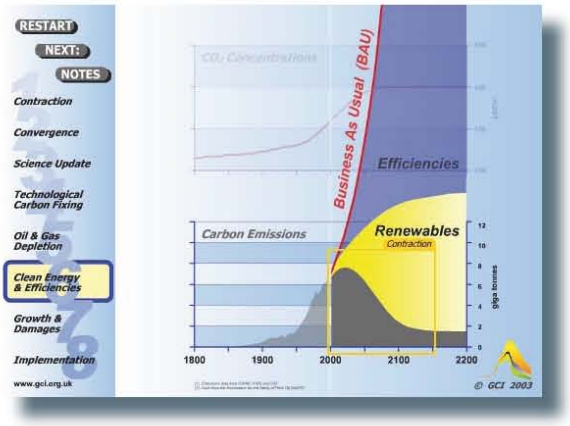
Calculations for the depletion model come from ASPO [the Association for the Study of Peak Oil] from whom more information is available.

At the same time, there is no shortage of proven coal reserves.

These charts demonstrate the declining amount of oil and gas production with greater or lesser amounts of coal production, as before, implying different total emissions consistent with different outcomes for atmospheric CO_2 concentration.

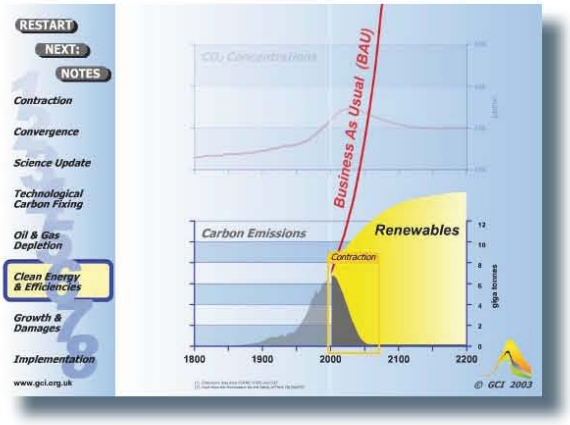
Renewable "Sunrise" and Efficiency "Moonrise"

If the global economy sustained a path integral at 3% growth per annum into the future, it would follow the "Business as Usual" curve shown as the upward red line.



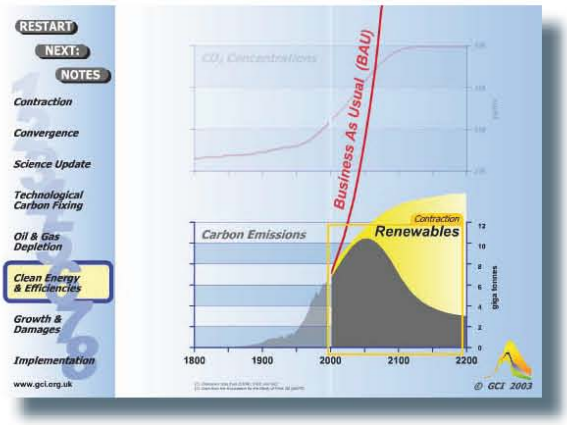
Especially in view of the impending climate and energy constraints, this seems increasingly unlikely.

If renewable energy sources are introduced vigorously under some sort of global Marshall Plan arrangements under-written by C&C, the physical supply limit might be around the 16 GigaTonnes carbon equivalent limit, as shown in the image.



Purely for the purposes of argument, the infrastructure implied in the supply curve shown ("Sunrise") is roughly equivalent to putting one third of Australia under radial mirrors for solar-thermal electrolytic production of hydrogen. [This is illustrative and not made as an advocacy point].

Economic "growth-optimists" assume unlimited growth, efficiency gains and privatisation.



Some argue that C&C is the safe-climate precondition of this or any growth.

Others say that the growth is the precondition of the safe climate.

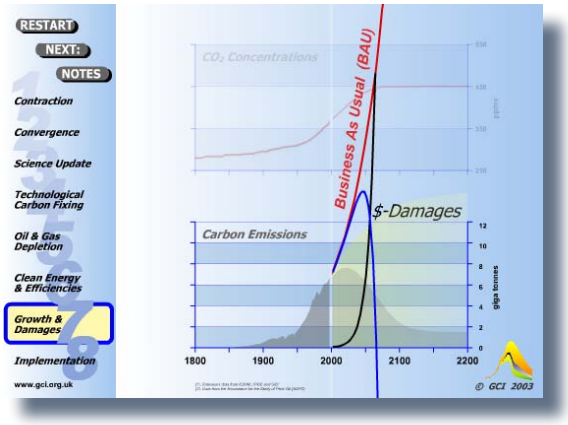
Yet others say that if it is a contest between growth and safe climate, the growth is preferable to the safe climate strategies and that 'adaptation' to changing climate is the only realistic option for humanity in the years to come.

The last two arguments are irresponsible and dangerous.

The first argument is correct. It says that safe climate is the precondition of whatever is viable and sustainable in the future. Without this, as the economist Richard Douthwaite says, "growth is an illusion."

Damages

Here, we introduce a damage curve (black curve) from climate related "natural disasters", projected in the decades ahead at three to four times the rate of the economic growth shown.



This rate simply continues the rate for uninsured economic losses recorded by Munich Re over the four decades, 1960 to 2000, where damages doubled per decade.

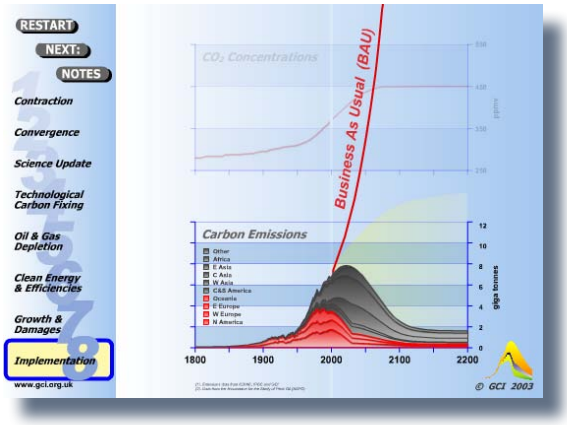
GCI is not saying this future is going to happen any more than were saying it isn't. We don't know and we don't know anyone who does.

What we are saying however is that this curve is widely quoted now and that it is better to project a trend of something rather than a blank.

When damages at this rate are subtracted from growth at 3% (blue curve), it is quickly apparent that the global economy is accelerating towards, rather than away from, bankruptcy as a result of increasingly dangerous rates of climate change.

Introducing North/South Regional Bubbles

GCI believes that the European Union provides a good model of regional cooperation. The world as a whole could organise and then negotiate inter-regionally, in a total of around 8 to 10 blocks.



The African Union provides a good example of an emerging region with a strong shared interest in avoiding damages from dangerous rates of climate change.

Using the NEPAD for example, the Union could benefit from the C&C basis of their global strategy.

Here, as with the EU for example, differential anomalies within the group can be resolved within the region, rather than at the UN.

Because of very low consumption rates in Africa, C&C creates purchasing power in the continent and terms of engagement with the world that are much improved against the status quo of debt and aid and continued emiseration at the hands of the global economy.

Emulating C&C, the European Union is creating its own intra-regional dynamics, where the high-end and low-end consumers such as Germany and Greece, compromise within the regional arrangement.

The South African anomaly of high per capita emissions within the African region results from consumption levels created under apartheid, largely from international mining operations. The EU experience suggests a way forward for African and indeed other unions.